

REMARKS

Reconsideration of this application is respectfully requested in view of the following remarks.

As a preliminary matter, Applicants appreciate the indication of allowable subject matter in claims 4, 7-8, 12-14, 16, 19-21, 23, 26-28, 31 and 32 of the present application.

Claims 1-32 are currently pending in the application and subject to examination.

In the Office Action mailed February 25, 2004, the Examiner rejected claims 1-3, 5-6, 18, 22, and 24 under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent No. 5,886,745 to Muraji et al. The Examiner rejected claims 9-11, 15, 17, 25, 29, and 30 under 35 U.S.C. § 103(a) as being unpatentable over Muraji et al. in view of U.S. Patent No. 6,192,158 to Abousleman. To the extent that the rejections remain applicable to the claims currently pending, the Applicants hereby traverse the rejections, as follows.

With regard to claim 1, Applicants submit that the claimed invention relates to an image interpolating method for interpolating a pixel at an intermediate position between a first original pixel and a second original pixel adjacent to the first original pixel, characterized by comprising:

a first step of calculating an edge component for judging whether or not an interpolated pixel exists in the vicinity of an edge position of original image data;

a second step of finding a range where pixel data on the interpolated pixel is settable on the basis of the calculated edge component and pixel data on the first and second original pixels;

a third step of selecting a plurality of sets of opposed pixels between which the interpolated pixel is sandwiched diagonally, and finding, for each of the sets, the pixel data on the interpolated pixel in a case where a correlation value represented by the sum of the absolute values of the differences between the pixel data on the interpolated pixel and pixel data on the opposed pixels is the minimum in the range where the pixel data on the interpolated pixel is settable and the minimum correlation value; and

a fourth step of finding the pixel data on the interpolated pixel on the basis of the pixel data on the interpolated pixel in the case where the correlation value is the minimum and the minimum correlation value which are found for each of the sets.

The Examiner has indicated that Muraji et al. discloses each and every limitation of the invention recited in claim 1. However, Applicants submit that nothing in Muraji et al. teaches or suggests the features of the present invention of (1) “finding a range where pixel data on the interpolated pixel is settable on the basis of the calculated edge component and pixel data on the first and second original pixels” and (2) “selecting a plurality of sets of opposed pixels between which the interpolated pixel is sandwiched diagonally, and finding, for each of the sets, the pixel data on the interpolated pixel in a case where a correlation value represented by the sum of the absolute values of the differences between the pixel data on the interpolated pixel and pixel data on the opposed pixels is the minimum in the range where the pixel data on the interpolated pixel is settable and the minimum correlation value,” as recited in claim 1. (Emphasis added).

One example of feature (1), *supra*, of the present invention, can be seen referring to Figure 1, in which pixel X is interpolated at the midpoint between the first original

pixel D12 and the second original pixel D22 adjacent to the first pixel D12. As the specification indicates, the edge component E may be calculated based on the equation below, taking, for example, a pixel just above the first original pixel D12 and D02, a pixel just below the second original pixel D22 as D32 and taking pixel data of D12, D02, D22 and D32 as d12, d02, d22 and d32, respectively:

$$E = -d02 + d12 + d22 - d32 \dots (20)$$

See specification, at page 33. The range S where pixel data x of the interpolated pixel X is settable, may be found by comparing the edge component E with a threshold value Th as shown, for example, in Figure 3. Specifically, if the larger pixel data of d12 (of the first original pixel D12) and d22 (of the second original pixel D22) is designated as d_{max}, the smaller as d_{min}, and the difference therebetween (d_{max} - d_{min}) as d, the relationship between the edge component E and the range S may be represented as follows:

$$E > Th \quad ; \quad d_{min} + (d/2) \leq S \leq d_{max}$$

$$-Th \leq E \leq Th \quad ; \quad d_{min} + (d/4) \leq S \leq d_{max} - (d/4)$$

$$E < -Th \quad ; \quad d_{min} \leq S \leq d_{min} + (d/2)$$

See specification, at pages 33-34.

As an example of feature (2), *supra*, of the present invention, two sets of the opposed pixels, each set of which sandwiches the interpolated pixel X diagonally, may be selected (for example, the sets D11, D23 and D13, D21 in Fig. 1). For each set, the minimum correlation value and pixel data x of the interpolated pixel X, which gives the minimum correlation value, are then calculated within the allowable range S of the pixel data x. In this example, the correlation value (L and R) represents the sum of the absolute values of the differences between the pixel data x of the interpolated pixel X

and the pixel data of the opposed pixels (i.e., $L = |d_{11} - x| - |d_{23} - x|$; $R = |d_{13} - x| + |d_{21} - x|$).

Specifically, within the range S of the pixel data x, the minimum of the correlation value in the diagonal direction L ($= |d_{11} - x| - |d_{23} - x|$), i.e., L_{\min} for the set of D11 - D23, and the pixel data x_l , which gives the minimum correlation value L_{\min} , are calculated. Likewise, within the range S of the pixel data x, the minimum of the correlation value in the diagonal direction R ($= |d_{13} - x| + |d_{21} - x|$), i.e., R_{\min} for the set of D13-D21, and the pixel data x_r , which gives the minimum correlation value R_{\min} , are calculated. The minimum correlation values L_{\min} and R_{\min} and the pixel data x_l and x_r , which gives the L_{\min} and R_{\min} , respectively, for the two sets (the set of D11, D23 and set of D13, D21) are subsequently used to calculate the pixel data x of the interpolated pixel X. If L_{\min} is less than R_{\min} , for example, the pixel data x is determined to be x_l . If R_{\min} is less than L_{\min} , the pixel data x is determined to be x_r . If L_{\min} and R_{\min} are equal, their mean value is taken as the pixel data x. See e.g., specification, at pages 35-37.

For at least these reasons, the Applicants submit that claim 1 is allowable over the cited prior art. As claim 1 is allowable, the Applicants submit that claims 2-8, each of which depends from allowable claim 1, are likewise allowable over the cited prior art.

Similarly to as discussed above with regard to claim 1, the Applicants submit that claims 9, 18 and 25 are allowable over the cited prior art at least because the cited prior art does not disclose or suggest the limitations of (1) “finding a . . . range where pixel data on the interpolated pixel is settable on the basis of . . . [an] edge component and pixel data . . .” and (2) “selecting a plurality of sets of opposed pixels between which the interpolated pixel is sandwiched diagonally, and finding, for each of the sets, the pixel

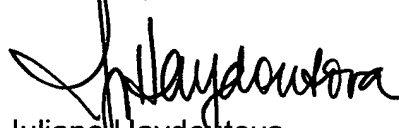
data on the interpolated pixel in a case where a correlation value represented by the sum of the absolute values of the differences between the pixel data on the interpolated pixel and pixel data on . . . [designated] pixels is the minimum in the range where the pixel data on the interpolated pixel is settable and the minimum correlation value," as recited in claims 9, 18 and 25. (Emphasis added). As claims 9, 18 and 25 are allowable, the Applicants submit that claims 10-17, 19-24 and 26-32 each of which depends from allowable claims 9, 18 and 25, respectively, are likewise allowable over the cited prior art.

For all of the above reasons, it is respectfully submitted that the claims now pending patentably distinguish the present invention from the cited references. Accordingly, reconsideration and withdrawal of the outstanding rejections and an issuance of a Notice of Allowance are earnestly solicited.

Should the Examiner determine that any further action is necessary to place this application into better form, the Examiner is encouraged to telephone the undersigned representative at the number listed below.

In the event this paper is not considered to be timely filed, the Applicants hereby petition for an appropriate extension of time. The fee for this extension may be charged to Deposit Account No. 01-2300, referencing Attorney Docket No. 107314-00020. The Commissioner is hereby authorized to charge any fee deficiency or credit any overpayment associated with this communication to Deposit Account No. 01-2300, referencing Attorney Docket No. 107314-00020.

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Enclosures: Petition for Extension of Time (1 month)

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